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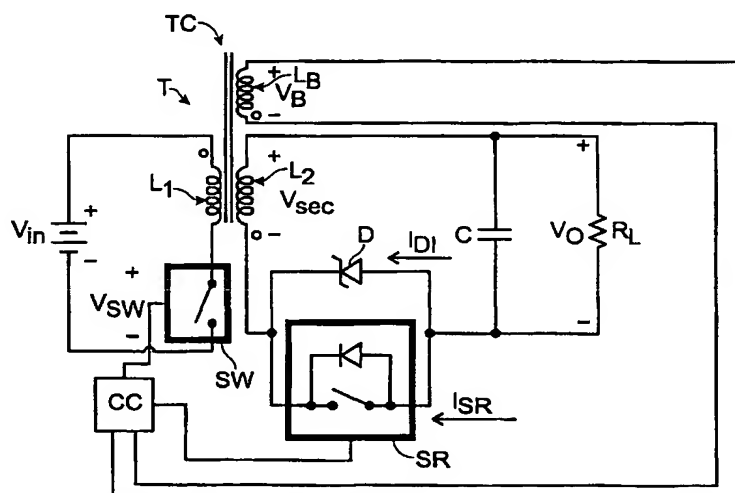
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(54) Title: METHOD AND APPARATUS FOR CONTROLLING A SYNCHRONOUS RECTIFIER



(57) Abstract: The present invention is directed to a switch mode power converter for supplying an output power to a load (R<sub>1</sub>), which includes a switching device (S<sub>r</sub>) at the secondary side having a switching input, a switching output, and a control input a transformer (T) coupling primary and secondary sides, a switch (S<sub>w</sub>) at the primary side, for enabling or disabling the switching device from conducting current from the switching input to the switching output. The converter also includes a network (L<sub>2</sub>, C) in which the switching device input, the switching device output, and the load are connected together to form a circuit. The converter also includes a bias winding (L<sub>B</sub>) in the circuit for producing a bias voltage (V<sub>B</sub>) representative of the output power (V<sub>O</sub>), and a control circuit (CC). The control circuit is for (a) determining the rate of change of the bias voltage, (b) characterizing the rate of change, and (c) controlling the control input as a result of the characterization (b).

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/CH 03/00203

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H02M3/335

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 991 171 A (CHENG KIM TUNG) 23 November 1999 (1999-11-23) abstract column 4, line 14 - line 51 column 5 figures 6,6A,9	1-4, 15-17
A	US 5 179 512 A (FISHER RAYETTE A ET AL) 12 January 1993 (1993-01-12) the whole document	1-17
A	WO 01 28079 A (LAMBDA ELECTRONICS) 19 April 2001 (2001-04-19) the whole document	1-17

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \* & \* document member of the same patent family

Date of the actual completion of the international search

3 October 2003

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10/10/2003

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CH 03/00203

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 1-17  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 1-17

The international searching division considers that the present application fails to comply with the clarity and conciseness requirements of Article 6 PCT (see also Rule 6.1(a) PCT) to such an extent that a complete search of the submitted claims is impossible.

All the claims 1-17 were searched in the light of the description, since the wording of the claims presently on file is not supported by the description, as their scope is broader than justified by the description and drawings.

The search has been carried out looking for a dc-dc switch mode power converters having the following features which are not present in independent apparatus claim 1:

- a TRANSFORMER (see the whole description and all the drawings) which couples primary and secondary sides of the circuit,
- a SWITCH ON THE PRIMARY SIDE (see the whole description and drawings)
- a SWITCHING DEVICE AT THE SECONDARY SIDE of the converter (see the whole description and all the drawings), said switching device having a switching input, a switching output and a control input for enabling or disabling said switching device from conducting current from said switching input to said switching output.
- a bias winding BEING PART OF THE SAME TRANSFORMER (see in particular page 16, line 4-5).

A search for the features actually present in claim 1 taken alone, i.e. without the above mentioned essential features, is not considered possible as it is absolutely unclear if such claimed features can be implemented in other kinds of switch mode power converters and, in affirmative case, in what type of converters.

The same reasoning applies to method claim 15 and obviously to all dependent claims.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CH 03/00203

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5991171	A	23-11-1999	NONE	
US 5179512	A	12-01-1993	NONE	
WO 0128079	A	19-04-2001	AU 7876000 A WO 0128079 A2 US 6442047 B1	23-04-2001 19-04-2001 27-08-2002